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## PATENT SPECIFICATION



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### COMPLETE SPECIFICATION.

#### Improvements in and relating to Loud Speakers and like Apparatus.

We, SOCIÉTÉ FRANÇAISE RADIO-ELECTRIQUE, a body corporate organised under the Laws of the Republic of France, of 79, Boulevard Haussmann, Paris, France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 This invention is for improvements in and relating to loud speakers and like sound-reproducing or sound-receiving apparatus of the electro-dynamic moving-coil type.

15 The invention has for its object to provide an improvement in loud speakers and like apparatus of this type, whereby a uniform response to applied vibratory energy may be obtained over a wide range of acoustic frequencies.

20 According to the present invention, there is provided a loud speaker comprising a plurality of membranes in the form of truncated cones having different dimensions from one another, each membrane being flexibly suspended at both its end edges, at one end by direct connection to a support for all the membranes, and electro dynamic driving means being arranged to act directly upon one only of said membranes.

Conveniently, the conical diaphragm surfaces are arranged concentrically one within the other and facing in the same direction.

35 According to a feature of the invention, in an arrangement of conical diaphragm surfaces as referred to above, the edge of a smaller conical diaphragm surface at the larger end thereof is resiliently attached to a larger conical diaphragm surface surrounding it, at a point intermediate the ends of said larger surface. It is found that this arrangement is to be preferred to other arrangements in that it affords superior acoustic results.

45 The invention will now be further described with reference to the accompanying drawings, which illustrate, by way of example an embodiment of the invention, as applied to a loud speaker for a radio apparatus, and in which:—

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Figure 1 is a diagrammatic representation in axial section of said embodiment, and

Figure 2 is a face view of a supporting element which may be employed in the construction according to Figure 1 for resiliently connecting the cones of the diaphragm unit at their smaller ends to the framework of the loud speaker.

Referring to Figure 1, the apparatus shown in this Figure comprises a single circular air gap provided between concentric poles N Q of a magnetic circuit. Immersed in this air gap is a coil B rigidly secured to the smaller end of a truncated conical diaphragm C<sup>1</sup>. Surrounding diaphragm C<sup>1</sup> and facing in the same direction, is a second cone C<sup>2</sup> which is supported from the framework of the loud-speaker by means of a resilient connection S<sup>2</sup>, and the cone C<sup>1</sup> is resiliently supported from the cone C<sup>2</sup> by a flexible connection S<sup>1</sup> attached to cone C<sup>2</sup> at a point intermediate the ends thereof.

The two cones C<sup>1</sup>, C<sup>2</sup> are adapted to be responsive to different preferred ranges of vibrations succeeding one another as far as possible uninterruptedly in the acoustic frequency scale.

Referring now to Figure 2 a suspension device is illustrated by way of example, suitable for use in the particular arrangement of cones illustrated in Figure 1. The coil B shown in Figure 1 is attached to the central circular part a of the suspension plate P, which latter is flexible and formed with apertures as shown. The resilient suspension of the coil B, and consequently that of cone C<sup>1</sup> rigidly attached thereto, is effected at the larger end of the cone by the aforesaid resilient attachment S<sup>1</sup> and at the smaller ends of the two cones, by narrow bridge pieces X of the suspension plate. The ring b of the suspension plate supports the smaller end of the cone C<sup>2</sup> and in turn is resiliently suspended from the framework of the apparatus by narrow bridge pieces O of the suspension plate.

It will be appreciated, that by suitably adjusting the resilient bridge pieces X connecting the two cones C<sup>1</sup>, C<sup>2</sup>, the larger cone C<sup>2</sup> may be caused to respond

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only to lower frequencies and to remain subsequently unaffected by high frequencies of small amplitude. Such an arrangement therefore provides a loud speaker having two operative ranges of response, in which the electro-dynamic driving means B of the loud speaker acts directly upon one only of the membranes, which is an important improvement as will be appreciated by those acquainted with the art.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A loud speaker comprising a plurality of membranes in the form of truncated cones having different dimensions from one another, each membrane being flexibly suspended at both its end edges, at one end by direct connection to a support for all the membranes, and electro dynamic driving means being arranged to act directly upon one only of said membranes.

2. A loud speaker according to Claim

1 in which the cones are arranged to face in the same direction as one another.

3. A loud speaker according to Claims 1 and 2, wherein the smaller bases of the cones are disposed in the same plane.

4. A loud speaker according to Claim 1 or 2 or 3, wherein the larger base of a smaller membrane is flexibly suspended from the surface of the largest membrane upon a circle intermediate of the ends of the latter.

5. A loud speaker according to Claims 3 and 4, wherein the flexible suspensions of the small bases of the membranes are connected to a single member formed from a sheet of flexible material.

6. A loud speaker or like device of the electro-dynamic moving-coil type constructed as herein described with reference to Figure 1, with or without reference to Figure 2 of the accompanying drawings.

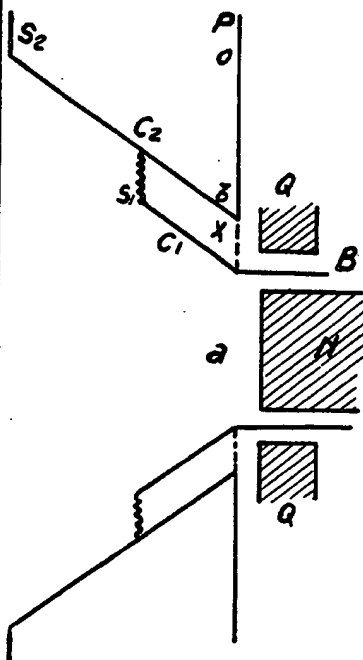
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*[This Drawing is a reproduction of the Original on a reduced scale]*

**Fig. 1**



**Fig. 2**

